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REPORT OF THE GEOMETRY COMMITTEE.

At the Pittsburgh meeting of this association this committee presented a preliminary report which outlined a plan of procedure. That report was approved at that meeting and published in the December, 1913, issue of the *MATHEMATICS TEACHER*. In that report the committee said that one of the first tasks which it had undertaken was that of preparing a suitable non-geometrical test to determine the results of geometry teaching as to reasoning ability, and in the report the committee gave five questions indicating in a general way the nature of the questions that should constitute such tests.

A request was made for the members of the association to send to the committee questions of a non-geometrical character which could be given to high school students. A few members of the association responded. From the questions thus gathered together a test was prepared, and that test has been given to several groups of students, and to two groups of teachers.

In a paper presented by the chairman of the committee at the meeting of the association in February, 1914, the list of questions composing this test was given. That paper was published in the *MATHEMATICS TEACHER* for March, 1915. It also contained the results obtained by giving the test to a group of high school girls. Following that, Professor C. E. Rogers, now of the East Tennessee State Normal School, Johnson City, Tennessee, gave the same set or a slightly modified set to five groups of students. Also Professor Leonard M. Passano gave the same set of questions to two groups of students in the Massachusetts Institute of Technology, and Professor Sarah E. Smith gave the set to two groups in Mt. Holyoke College. Professor Rogers compiled the results of the test given by him and they were published in the December, 1915, issue of the *MATHEMATICS TEACHER*. Professor Passano compiled the results of the test given by himself and those given by Professor Smith and they also were published in the same issue.

For future reference I have numbered these various groups as follows:

1. Forty-four high school girls to whom the test was given by the chairman of the committee. This whole group had covered the first two books of plane geometry, and had also studied constructive geometry for one quarter of a year. The coefficient of correlation between the results of this test and their marks in plane geometry is .50 with a probable error of .08. It was a fairly homogeneous group, and consequently one would expect the frequency curve for measurements of reasoning ability to be approximately normal. The chairman also computed the coefficient of correlation between the results of this test and the marks obtained in English. In this computation the English marks were not available for two of the students. The coefficient of correlation thus obtained is .32 with P.E. of .10.

2. Thirty-eight girls in the Horace Mann School to whom the test was given by Professor Rogers. All the students in this group had completed the usual amount of plane geometry, and all were in the fourth grade of high school. Consequently this group was also fairly homogeneous. The coefficient of correlation with their geometry marks is .75 with P.E. of .05.

3. Eighty-four girls in the Washington Irving High School to whom the test was given by Professor Rogers. All the students in this group were studying Book V in plane geometry at the time the test was given, and all were in the third year of high school, so that this group also was fairly homogeneous. The coefficient of correlation with their geometry marks is .31 with P.E. of .07.

4. Twenty-nine girls in the Horace Mann School to whom the test was given by Professor Rogers. They were for the most part third-year high school students and the amount of time previously spent in plane geometry varied from one quarter of a year to a whole year. This group, as far as the study of plane geometry was concerned, was not nearly so homogeneous. The coefficient of correlation with the geometry marks is .25 with P.E. of .12.

5. Thirty-eight young ladies and gentlemen in the East Tennessee State Normal School to whom the test was given by Professor Rogers. Their classification corresponded approximately

to the fourth year high school grade, but their average age was a little over twenty, that is, appreciably higher than the average age for fourth year high school pupils. Practically all of them had completed plane geometry within a year. The coefficient of correlation with their class marks is .52 with a P.E. of .12.

6. Forty-eight mathematics teachers in attendance at the joint meeting of the New England Association and the Association of the Middle States and Maryland, February 28, 1914, to whom the test was given by the chairman of this committee.

7. Twenty-four young ladies and gentlemen in Teachers College. These students were all of the maturity of ordinary college students, and at the time the test was given were taking a course in Teachers College in the nature of a practicum in the teaching of mathematics. It was not feasible to obtain the data for the computation of the coefficient of correlation with the geometry marks.

8. Thirty-three freshmen in the Massachusetts Institute of Technology to whom the test was given by Professor Leonard M. Passano. This test was given when they had nearly completed the work of the freshman year. The mathematics of the freshman year there includes plane and solid analytical geometry and differential calculus.

9. Thirty-two sophomores in the Massachusetts Institute of Technology to whom the test was given by Professor Passano. The test was given near the end of the sophomore year during which they had studied elementary calculus and elementary differential equations.

10. Twenty sophomores in Mount Holyoke College. Previous to this test they had had a half year of analytical geometry and a half year of calculus.

11. Twenty-one juniors in Mount Holyoke College. They had had an additional year's work in calculus.

No coefficient of correlation was obtained for either of the groups in the Massachusetts Institute of Technology nor for either of the groups in Mount Holyoke College.

The following table (Table I) gives the percentages of the various groups making the different possible scores. The numbers at the top of the columns give the number of points scored.

In the case of groups 2, 3, 6, 8, 9, 10 and 11 the set of ques-

TABLE I.

No. of Group.	0	1	2	3	4	5	6	7	8	9	10	11
1	0	2	5	23	11	25	25	7	2	0		
2	0	0	5½	2½	24	10	24	18	13	3		
3	0	2½	6	14½	15	36	19	7	0	0		
4	3½	3½	14	21	34	10	7	7	0			
5	0	0	0	5	0	15	14	8	21	27	5	5
6	0	0	0	0	6	4	12½	15	25	37½		
7	0	0	0	4	8	17	25	8	38			
8	0	0	3	0	3	12	24	9	30	18		
9	0	0	0	0	6	9	9	19	34	22		
10	0	0	0	0	5	0	15	30	35	15		
11	0	0	5	0	0	5	5	19	33	33		

tions given was identical with that given by the chairman of the committee in the paper published in the MATHEMATICS TEACHER of March, 1915, and reprinted in the paper of Professor Passano in the MATHEMATICS TEACHER of December, 1915, and also reprinted in the paper of Professor Rogers in the last mentioned issue.

In the case of groups 4 and 7, question II (4) was inadvertently omitted, and in the case of group 5 Professor Rogers added two additional questions. In the case of groups 4 and 7 the maximum possible score was eight points, and in the case of group 5 the maximum score was eleven points. In the case of the other groups the maximum score was nine points.

The following table (Table II) gives the percentages of each group scoring on the different questions. The numbers at the top of the columns are the numbers associated with the questions in the chairman's paper in the MATHEMATICS TEACHER of March, 1915.

TABLE II.

No. of Group.	I.	II(1).	II(2).	II(3).	II(4).	III.	IV(1).	IV(2).	V.	VI.	VII.
1	70.0	50.0	84.0	73.0	64.0	14.0	11.0	84.0	16.0		
2	82.0	57.0	89.0	55.0	84.0	42.0	34.0	87.0	37.0		
3	58.0	65.0	93.0	66.0	59.0	23.0	11.0	74.0	17.0		
4	67.0	42.0	73.0	55.0		17.0	7.0	83.0	31.0		
5	82.0	84.0	89.0	76.0	89.0	29.0	11.0	79.0	42.0	68	55
6	94.0	98.0	100.0	96.0	96.0	73.0	75.0	71.0	58.0		
7	83.0	62.0	83.0	67.0		67.0	83.0	83.0	71.0		
8	93.9	66.7	100.0	72.7	81.8	39.4	90.9	87.9	60.6		
9	87.5	90.6	100.0	90.6	84.4	31.2	93.7	87.5	65.6		
10	95.0	80.0	100.0	75.0	100.0	60.0	80.0	95.0	50.0		
11	100.0	90.5	95.2	81.0	95.2	52.4	81.0	85.7	81.0		

A study of Table I shows that the distribution was approximately normal for those groups that consisted of students of the usual high school age and maturity. Moreover, in each of those cases there is a fairly good-sized coefficient of correlation between the results of this test and the geometry marks. In cases of more mature students the distribution is very much skewed towards the large scores.

Up to the present time the purpose has been to determine the reliability of this test as a measure of reasoning ability.

The committee believes the above data to show that the test is fairly reliable, but it believes, nevertheless, that it can be improved.

Table II shows that questions III, IV (1) and V were the most difficult. Professor Rogers has called attention to this fact and has suggested substitutes for III and IV (1).

The committee believes the acceptance of Professor Roger's substitutes will improve the test.

At least three possible lines of action are now open from which to make a choice :

1. Proceed now to give this amended test to a large number of persons as explained in the committee's first report, and then analyze the results.
2. Make further efforts to improve the test and make more trials as to its reliability, before using the test as explained in the committee's first report.
3. Abandon the plans of the committee as given in the first report.

The committee believes that the choosing of the next line of action is so important that it should be given consideration by a body more representative of the whole membership of the Association than this small committee and therefore recommends that the Council review the reports of this committee and determine upon the next line of action.

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